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ADDRESSING DEVELOPMENTAL NEEDS Through Energy Access in Informal Settlements

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SELCO Foundation is a 5-year-old organization that engages in ecosystem building for deployment of clean energy solutions that alleviate poverty in tribal, rural and urban poor communities. The organization works closely with practitioners in the social sector, energy entrepreneurs and partners from various developmental sectors.

KEYWORDS

- ENERGY ACCESS
- URBAN SLUMS
- SOLAR
- LIVELIHOODS

Integrated Energy Centres, solar power community hubs for need based services, have been operationalised by SELCO Foundation for informal migrant communities in Karnataka, India since 2011. There are 26 IECs till date, offering 22 different services. Through the interventions, 6074 households have been impacted. The paper describes three different models through case studies illustrating their operational and financial aspects.

INTRODUCTION

Migration is one of the main drivers of urbanization, and in Indian cities urbanization has been characterized largely through internal migration (UNESCO, 2011). India's urban population was 79 million in 1961 and rose to 377 million in 2011. Urban migrants predominantly work as unskilled labourers and are associated with the informal sector. Without a steady income or significant assets, they live in highly vulnerable conditions, often squatting on private or public land. This lack of proper housing and therefore proof of identity of residence in the city, serves as a major barrier to their inclusion in the formal sector. Leading to exclusion from basic rights in the city (right to subsidies through the Public Distribution System), right to avail justice (in case of re-settlement and slum demolitions), as well as preventing entry into the formal sector (cannot open a bank account or obtain a driver's license etc). Thus, lack of access to these basic rights denies people of appropriate opportunities, better incomes, education and a decent standard of living. Further, energy poverty keeps the poor locked out of the global economy, not only because they cannot access education, health care or jobs, but because their time, labour and large percentages (30-40%)[1] of their non-expendable income is consumed in foraging for rudimentary sources of power – from wood to dung – that their families require.

According to the International Energy Agency (IEA), globally a total of 208 million people living in urban areas do not have access to electricity (IEA, 2011). Karnataka is home to about 730,000 households[2] that live in informal

1 Based on SELCO Foundation's need assessment survey data

2 This captures households within slums that are notified or legally recognised by the government. The real number of non-notified informal settlements within Bangalore itself is estimated to be more than 1,500 (The Association for Promoting Social Action (APSA) as reported in Daily News and Analysis (DNA), 2015)

settlements, over 55,000 households reported not having access to any electricity (Census 2011).

Keeping the above challenges in mind, this article is an attempt to analyse and study the Integrated Energy Centres (IEC), one of the models used by SELCO Foundation, to use electricity as a catalyst for improving well-being and livelihoods in informal settlements.

1. SOLUTION: INTEGRATED ENERGY CENTRES

1.1. DESCRIPTION OF THE IECS

Integrated Energy Centres (IECs) are solar powered community centres that can host a range of basic services and activities lacking in an underserved community. While electricity is one of the recurring needs of these vulnerable communities, IECs bridge the last mile gap by providing access to other services, education, health etc. The IEC is envisioned to become a community space where the user can charge their mobile phones without walking to the closest source of energy that is sometimes kilometers away; get access to purified drinking water; find batteries and lanterns on rent; as well as gain access to educational aids such as computers, televisions or projectors.

Aerial view of Vasanthnagar: Due to the temporary nature of their tenure, urban poor live in small tarpaulin sheet tent like structures which prevent them from gaining access to important infrastructure and services including electricity, basic health and sanitation - Source: SELCO Foundation

A needs assessment exercise is conducted in the community, capturing basic demographic information, income, spending on energy and the community's most felt needs through a combination of interviews with different stakeholders (which include potential IEC operators/entrepreneurs, land owners, contractors etc) as well as focus group discussions with the community. Each IEC is custom designed to cater to the need in a community such that every aspect of it can be sustainable. Thus, each IEC is unique.

The important features of an IEC, that make it an ideal solution for the context of informal settlements are captured below.

1. Decentralized renewable energy - DRE solutions were deemed appropriate for these communities as existing solutions such as getting connected to the grid is not a viable option due to the lack of identity proof, lack of land ownership documents and high cost of connection. Additionally, individual solar home energy systems might not be the best solution due to their high capital cost, little or no access to financing and the migratory nature of the communities. For basic energy access, solutions such as portable lanterns were not seen as cost effective over a period of time due to a lack of servicing options.
2. Built structure - The IEC could be housed in existing home, shop or community hub, and can be built in a way that it can be moved relatively easily (prefabricated components and the use of dismantlable or re-usable materials) or could be mobile in nature (on a cart, rickshaw etc).
3. Customisable modular design - The services and/or amenities in the IECs are designed in a modular manner (see Table 1). Additional services are added onto systems as modules, i.e. a solar fridge would come in a package that includes a panel, charge regulator, and a battery, all customised to maximise efficiency and minimise costs. This modular design allows for flexibility and the ability to add on services based on entrepreneur and community needs as well as their ability to pay.

"DUE TO THE TEMPORARY NATURE OF THEIR TENURE, URBAN POOR LIVE IN SMALL TARPAULIN SHEET TENT LIKE STRUCTURES, WHICH PREVENT THEM FROM GAINING ACCESS TO IMPORTANT INFRASTRUCTURE AND SERVICES INCLUDING ELECTRICITY, BASIC HEALTH AND SANITATION."

Table 1. Sample technical specifications of the modules for lighting, mobile charging, and digital education services

Equipment	Unit	Wattage	Number of distribution boxes	Battery	Charge Regulator	Panel
LED light system	10 solar LED systems	3 W per lights	1	60 Ah (x 10 lights)	10 A	75 Wp
Mobile charging station	10 mobiles charged at the same time	5 W	1	60 Ah	10 A	50 Wp
Projector/visual aid for education	1 projector	35 W	NA	60 Ah	10 A	75 Wp

Source: SELCO Foundation

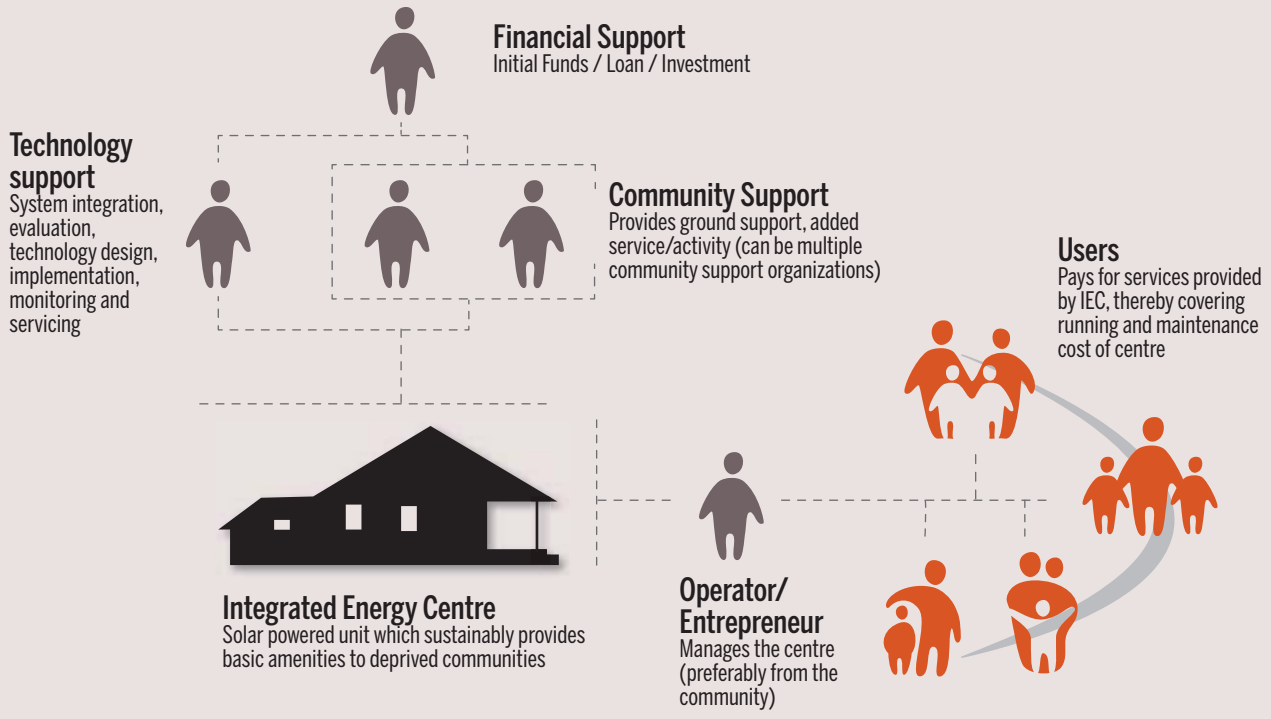
4. Ownership and financial model of the IEC - Entrepreneur, operator, partner and community owned depending on what works best within the settlement (as explained in Table 2). The decentralized concept of an IEC, allows the model to be custom designed according to the community. For example: as mentioned earlier, the urban migrants work as daily wage labourers, forcing them to make economic decisions on a day-to-day basis. Thus, for such communities, a daily rental model of energy services proves to be a more feasible and desirable solution.

The IEC is a dynamic concept, constantly evolving based on community needs. These communities may range from urban migrants to communities impacted by a natural or man-made disaster or a floating population.

1.2. THE DIFFERENT MODELS TO MANAGE AN IEC

In urban informal settlements, access to basic electricity (light and mobile charging) is often identified as the first intervention needed amongst the households, and thus is an easy entry-point intervention. In rural and tribal areas, the interventions might be education, health or livelihood focused. The financial sustainability of models is customized depending on the perceived value, the

IEC Structure and main aspects of its implementation. Each of the three support roles are key to successful running of an IEC.



Source: SELCO Foundation

Figure 1

willingness and ability of the community to pay, and access to local financing. Examples of designing a financial model could involve a minimal safety deposit, and an affordable fee for services. This allows for not only a financially sustainable project but also a fulfillment of the felt needs of a community.

SELCO Foundation developed four types of models:

1. Partner - the partner organization owns the IEC and regulates or monitors the daily usage. The partner may or may not integrate its own services into the model and hire a local community member as the operator of the IEC.
2. Operator - a model where SELCO Foundation is the key risk taking agency. An operator is hired from the community to maintain records, collect rent and take charge of the equipments. A part of the rent may be used for servicing and maintenance and the operator's fees. The balance amount is taken as a monthly deposit by the operator to buy back the system. The ownership of the IEC lies with SELCO Foundation till the operator has bought back the system through the rent collected. In communities where land rights and number of households are uncertain, this model helps to initiate services, demonstrate the viability of the technology as well as the solution and build the capacity of the operator. After a few months, some operators choose to turn into entrepreneurs.
3. Entrepreneur - entrepreneur directly invests in the IEC and in most cases avails a loan to buy the systems and set up the IEC. Typically, it is the first time these entrepreneurs interact with the formal banking system. Thus, there is a strong financing component required in this type of model.
4. Community - the IEC is collectively owned and managed by the community. There is no single operator to the IEC. It is a preferred solution for communities that are very homogenous in the social and cultural contexts.

During the design of IEC, one of the key criteria is the aspect of risk sharing between different agencies (through entrepreneur debt financing in the case of the entrepreneur model, a supporting and supervisory role of the partner in the partner model, and community cohesion in the community model for instance). While bearing the financial risk initially helps to provide backing to the operator (one who manages and runs the IEC) in the gestation period of the IEC, the sharing of risk and connection with financial institutions encourages the development of local entrepreneurs.

This aspect of risk sharing may also be directly connected to the second criteria of absence of ecosystem factors, such as:

I. Socio-economic factors: insecure land tenure and hence, prone to eviction, lack of documentation, social stigma attached to the household due to their status in the community.
II. Financial factors: no access to formal financial institutions - termed as "risky" due to their socio-economic status and/or insecure land tenure.
III. Technological factors: lack of infrastructure, the need for bringing in aspects of energy efficiency, human-centred design.
IV. Capacity building: the need for building awareness amongst the community members on the technology as well as building the capacity of the operator and entrepreneurs in monitoring, maintenance and bookkeeping etc.

"THE INTEGRATED ENERGY CENTRE CREATES AN ECOSYSTEM THAT CATALYSES OTHER DEVELOPMENT ACTIVITIES, BY BUILDING TRUST IN THE COMMUNITY, CREATING INFRASTRUCTURE AND INCREASING ACCESSIBILITY OF CLEAN SUSTAINABLE RESOURCES IN THE COMMUNITY."

Table 2 highlights the enabling factors that are considered while choosing the IEC's operational model.

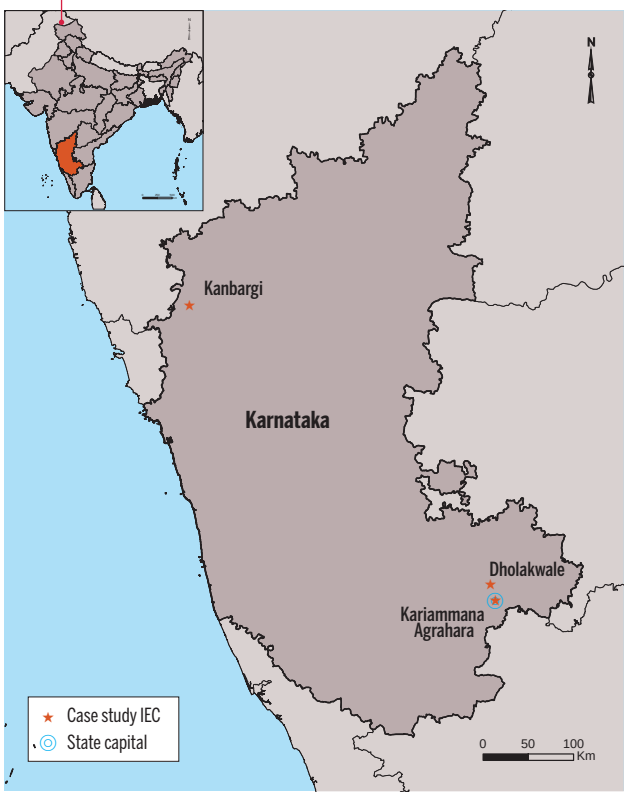
Table 2. Need assessment and model selection

Main factors considered for model selection	Model chosen
• Homogenous Community – no social hierarchy, bound by work & social norms • Live, work, travel together- high social capital • Have a tradition to collectively own things	Community Model
The ownership or operations of the IEC or IEC services are partner driven if the partner: • Has a strong presence in the community • Contributes in terms of technology, monitoring, servicing and or adding services (may or may not have an energy component)	Partner Model
Operator model: The operator is voluntarily nominated by the community or identified as a leader and or someone with entrepreneurial skills. An operator model, if chosen, is done by selecting an individual who has: • A good relationship with the community • Basic bookkeeping skills • Motivation/entrepreneurial spirit	Operator Model
An entrepreneur owned model is chosen if: • IECs potential has been proven & the operator chooses to take on entrepreneurship • The entrepreneur is able to acquire financing (usually facilitated by the Foundation or a partnering entity) • The community is relatively stable	Entrepreneur Model

Since 2011, 26 IECs have been installed offering 22 different services to the communities. These services are as varied as lighting, mobile charging, education, health, entertainment, awareness, photo studio, ticket booking, water purification etc. The IECs can also serve as a centralized charging station for machines such as sewing machines, laptops, projectors, soldering guns, televisions, refrigerators and incense making machines for livelihood based interventions. Additionally, the IECs provide services such as day care services, Alcoholics Anonymous counseling, banking services, market linkages, product diversification support, health care services and printing services.

The different models are distributed as follows: 1 community model, 1 partner model, 22 operator models and 2 entrepreneur models. It is important to note that the 2 entrepreneur model IECs, were previously run through an operator model. Operator driven models are most common due to the vulnerable nature of the communities - lack of financing, insecure land tenure. Entrepreneur models require the identification of a willing entrepreneur, which can sometimes be challenging.

Figure 2. Case study location - Source: FERDI



The development of the IECs is as presented in Table 3.

Table 3. Development of the IECs

	2011	2012	2013	2014	2015	Total
Urban	0	3	6	1	4	14
Rural	1	1	0	0	2	4
Tribal	0	0	0	4	4	8
Total	1	4	6	5	10	26

Source: SELCO Foundation

2. CASE STUDIES

This paper is based on research conducted in Karnataka, India in 2014. It employs a mixed qualitative methodology. Interviews were conducted with 50 community members (including the communities of the 3 cases studies), over a period of two weeks. Three operators or entrepreneurs were also interviewed. In the community, the interviews were conducted with direct beneficiaries of the Integrated Energy Centres, as well as community members who were aware of the intervention but were not using its services. Such social research tools were deemed appropriate for exploring the multifaceted issues relating to energy access in urban slums.

2.1. CASE STUDY 1: PARTNER MODEL: KANBARGI, BELGAUM (2013)

2.1.1. Background

A settlement of about 200 households, this slum rests on land that is under litigation for the past 16 years. Mahesh Foundation, a local NGO working for the welfare of children and youth in underserved populations wanted to actively work on health and education issues in the slum. Through the partner model, an IEC was seen as an effective entry point intervention for the community, serving as a "community hub" for development initiatives.

2.1.2. Implementation

Health: Mahesh Foundation runs a health clinic in the IEC every Tuesday, Thursday and Saturday. The regular consultation visits, helped identify a pattern of diseases that were water-borne, thus, helping identify the next intervention in the community - access to pure drinking water (this is currently being worked on by SELCO Foundation, together with Mahesh Foundation).

Lighting and Mobile Charging: A dark patch in the midst of an urban area, basic lighting was identified as a felt need by the community. The IEC thus, started off by providing lighting systems. Presently, it delivers light to 140 households, directly impacting approximately 840 individuals. The community used to spend around Rs. 50 per month to charge their mobiles in nearby shops. Some of them also reported of thefts from these charging points. They now have access to a mobile charging station at the IEC.

Education: An Anganwadi (government sponsored child and mother care centre) and basic literacy program runs every day at the centre. Mahesh Foundation also uses light as an incentive to promote education i.e the light can be rented by households that send their children to school. In January 2015, a solar-powered projector was installed to encourage educational programmes

Integrated Energy Centre in Kanbargi with Mahesh Foundation serves as a solar powered community centre with education and health facilities, in addition to being a charging station for lights and mobile phones - Source: SELCO Foundation

for the children as well as health awareness programmes for the community. A different social issue is selected every week and a film is shown in the community followed by an open discussion. About 30-40 community members participate every week.

Financial Literacy: With the help of a local financial institution, a bank account opening drive took place at the centre in 2014. This drive leveraged the Pradhan Mantri Jan Dhan Yojana (PMJDY) a scheme to open special zero balance bank accounts for the unbanked population. Approximately 300 new accounts were opened, a significant step towards financial inclusion of the community.

Thus, the IEC creates an ecosystem that catalyses other development activities, by building trust in the community, creating infrastructure and increasing accessibility of clean sustainable resources in the community.

2.1.3. Financial Model

Since this is a partner model the cost of the system and delivery of the services was borne by the partner (Mahesh Foundation). The cost of the structure of the IEC, which was set up more like a community space was seen as a one-time ecosystem building cost by SELCO Foundation. By subsidizing the cost of setting up the structure, the community as well as the NGO is allotted a space that serves as a catalyst for several developmental activities in the community.

While the education and health facilities are free, the financial model for the IEC was designed in a way that the renting of the lights and mobile charging would cover the operations and maintenance of the IEC. As the community is more comfortable with cash flows on a daily basis, the rent charged is Rs.5 per day. On an average, lights are rented out on all days of the month and thus the total revenue is Rs. 150 per month/ light. Through the rent collected, the operator (a community member, identified and employed by the partner organization to run and monitor the day to day activities of the centre) gets a fee of Rs. 2,000 per month.

2.2. CASE STUDY 2: COMMUNITY MODEL: NOMADIC DHOLAKWALE COMMUNITY (2013)

2.2.1. Background:

This settlement is a nomadic north Indian community that is skilled in crafting percussion instruments called *dholaks*. The men in the community craft their *dholaks* and live with their families on encroached public land. Lighting is an important social and economic need as their homes serve as a living and working space. Each drum is priced at Rs. 100. The men roam the streets with *dholaks* on their backs and occupy the main traffic junctions to sell them. Able to carry approximately ten *dholaks* at a time, a physically laborious process, their per day sales were also limited by their carrying capacity. While on better days, they were able to make around Rs. 1,000, most of the days it was hard for them to make any sales above Rs. 100-200. Further, in our need assessments, kerosene was seen as a high expenditure (almost 10-15% of their monthly income). A good quality lighting solution was not only identified by the community as an important aspect to their wellbeing and security, but also directly connected to their livelihood-providing them with longer days, and flexibility of working hours. The artisans also expressed their difficulty in keeping up with the demand during peak seasons, due to the inability to work after sunset.

Being an economically vulnerable community, providing portable and efficient home lighting systems to them was a challenge. When approached with the IEC concept, the families came together and showed a keen interest in the project. They were also willing to put down a deposit for the same. As pointed out by one of the interviewees, Azma, "We all share the responsibility, or in a way we are each responsible for our own batteries. If I want my light to work properly, I will take care of it and put it for charging on time. Similarly, as soon as it's dark, I will collect it from the charging station

Open Tarpaulin Tents serving as living and work spaces for the Dholakwale nomadic community Source: SELCO Foundation

Mobile IEC for Dholakwale Community
Source: SELCO Foundation

in the evening. We don't need any one person to do this for us." It is important to point out that, a close knit, socio-economically homogeneous community is a prerequisite for the smooth functioning of the community IEC model.

Following the intervention, while they were able to increase production of the *dholaks* (percussion instruments), they were unable to match it with an increase in sales. Thus, it was realised that the benefit of the technology (in this case, the light) would only be met if it was supplemented by an intervention that helped connect them to a larger market and looked at product diversification to increase their market segment. SELCO Foundation, thus looked at livelihood interventions that helped diversify their product range, connect them to exhibition spaces to cater to the urban market.

Based on the pre-intervention survey, annual income on an average was approximately Rs. 50,000 per household. Post-intervention, the annual income on an average increased by 10-20 percent. The exact amount is difficult to quantify due to the unwillingness of members to divulge specific financial details, and lack of basic bookkeeping. However, from one of the data points we were able to capture, the total profit made by the community from participating in handicraft exhibitions[3] alone (facilitated by SELCO Foundation) was Rs. 30,000.

Designing an IEC for a Nomadic Community: Since the community is nomadic, they move every 6-8 months depending on the proximity to different markets in the city. Additionally, they are highly prone to eviction. This was visible in the way that the households interacted with their physical environment- few or no assets and easy to assemble (and disassemble) tents. Thus, portability of the IEC was crucial. A simple mobile vending cart was modified and used as the housing entity.

3 A market platform showcasing handmade goods

2.2.2. Financial Model

This model includes a 'rent purchase' model. The community pays a monthly instalment to SELCO Foundation, which over a period of time would cover the capital cost of the system. An initial token amount of Rs. 200 was collected from every household before setting up the system and thereafter, every household paid Rs. 100 a month. The total repayment is not yet complete but when enough collections have been made, the community will own the system. The service and maintenance costs is Rs. 1,055 a month (Rs. 35 per household per month), the community will continue to pay the service and maintenance cost after the capital costs are recovered.

2.3. CASE STUDY 3: ENTREPRENEUR MODEL: KARIAMMANA AGRAHARA (2013)

2.3.1. Background

The Kariammana Agrahara slum houses over 500 households from different parts of Karnataka and Tamil Nadu. Migrant labour families have been residing here since 2010, working as contractors, labourers, cleaners, carpenters, gardeners etc.

An existing entrepreneur, Kumar, who runs a petty shop in the slum was chosen as the operator for the IEC. His existing business, relationship with the community, and entrepreneurial skills were beneficial for the centre to run smoothly and expand quickly. Similar to the first case study, the centre was designed to serve as a foundation for other activities in the community. The IEC was thus designed with a community space - allowing provision for activities like awareness campaigns, community TV programs, projector and laptop usage for educational activities.

Initially, 30 households in the community were introduced to solar portable lighting solutions. Several demonstration activities and awareness workshops were conducted in the community to build trust for the technology as well as awareness around the usability. Experiencing the positive benefits from its use, 80 households were renting out lights within 8 months. Seeing a business potential, in November 2014, with the help of the Small Scale Sustainable Infrastructure Fund (S3IDF), Kumar was able to take a loan,

Entrepreneur Kumar at his petty shop in Kariammana Agrahara (Before IEC intervention)
Source: SELCO Foundation

purchase 120 systems (battery and light) and become an IEC entrepreneur. Since then, through the relationship built with Kumar, and the community, the Foundation has been able to explore other services through partner organizations (health camps, literacy groups) and help expand livelihood opportunities.

2.3.2. Financial Model

Currently, after 2 years of initiation of services, Kumar makes a revenue of Rs. 28,000 a month by renting out 140 lights (on an average) at Rs. 200 a month. There was a small grant given initially in order to jump start the business and after that Kumar has taken a loan for a second set of lights and then an expansion loan as well. The total Equated Monthly Installment that has to be paid for these loans is approximately Rs. 9,411 per month. Kumar also spends Rs. 5,050 per month on the service, maintenance and replacement of parts. Thus, he saves approximately Rs. 13,539 per month through the business.

2.4. SUMMARY OF FINANCIAL MODELS

Table 4 describes the key financial data for the IECs including infrastructure costs, revenue generated by renting out services, and the income for the operator/entrepreneur. While some services cannot be monetised, such as those related to dissemination of information, education and health, a financial model is developed around the services that can be monetised. Critical to designing the financial model is achieving a balance between the instalment amount to be paid by the households, and the time required to achieve financial sustainability (break-even period). The quality of services designed for the warranty period, servicing, presence of supply chain and the utility of the end user play a key role in determining the financial sustainability of the project.

Further, while the financial model does keep in mind the sustainability of the project, the social costs and benefits that occur through the interventions are difficult to monetise. As a result the costs which focus on creating a public good in the form of infrastructure (community centre) or knowledge (innovation and capacity building), are seen as ecosystem building costs and may need to be subsidised (the ecosystem factors have been discussed in Section 1).

"THE COSTS WHICH FOCUS ON CREATING A PUBLIC GOOD IN THE FORM OF INFRASTRUCTURE OR KNOWLEDGE, ARE SEEN AS ECOSYSTEM BUILDING COSTS AND MAY NEED TO BE SUBSIDISED."

Table 4. Key Financial Data

PARTICULARS	KANBARGI	DHOLAKWALE	KARIAMMANA AGRAHARA
MODEL	PARTNER	COMMUNITY	ENTREPRENEUR
First Level Interventions			
Cost of IEC Structure	Rs. 180,000	Rs. 18,000	Rs. 200,000
Cost of IEC System	Rs. 250,000	Rs. 120,000	Rs. 555,000
Number of Lights	110 lights Avg. number of lights rented out every month	30 lights Avg. number of lights rented out every day	150 lights Avg. number of lights rented out every day
Income of Entrepreneur	Rs. 2,000/month Salary of operator	Nil	Rs. 13,539/month
Fees Associated with Lights	Rent/day Rs. 5 Monthly rent from lights is Rs. 1,200	Rent/day Rs. 100 Monthly rent from lights is Rs. 2,500	Rent/day Rs. 200 Monthly rent from lights is Rs. 28,000
Second Level Interventions			
Added Services	Health Clinic Schools Water Purification Financial Literacy	Market Linkages Product Diversification	Refrigeration Water Purification

3. RESULTS

While there are a number of benefits from IECs, both tangible and intangible, this paper draws out some of the observed livelihood, health and safety, and economic benefits that were illustrated through the case studies. Some of the more intangible benefits not discussed include an increase in study time for school going children, a sense of safety, flexibility in determining one's schedule, and the simple pleasure of being able to see at night.

3.1. LIVELIHOOD

As illustrated in case studies 2 & 3, the impact on livelihoods is significant for both the energy entrepreneur and the community by reducing the amount that is spent on kerosene for lighting and extending the hours of productivity. However, increase in production as in the case of the Dholakwale community, does not necessarily translate into economic gains. Other factors such as product diversification and market linkages need to be implemented to improve livelihoods. Kumar (Case study 3) said, "My earnings have doubled since I started working as an IEC entrepreneur". While another interviewee reported, "Earlier I had to finish cooking at home by 5:30, so at least the kids can finish eating by 6 while there is still some light outside. Now with access to light I am able to go to one more house for work in the evening" says Shivamma, domestic helper.

3.2. HEALTH AND SAFETY

Since one of the main sources of energy in these informal communities is kerosene, use of solar lighting reduces the dangers to health and safety from the noxious fumes and naked flames, providing much needed relief from smoke throughout the night. Field observations and interviews highlighted a self-perception of improvement in health including reduction in burn injuries from using kerosene or candles for lighting. Additionally, there was a sense of increased safety from harmful animals such as snakes and scorpions as a result of access to improved lighting.

"EARLIER I HAD TO FINISH COOKING AT HOME BY 5:30, SO AT LEAST THE KIDS CAN FINISH EATING BY 6 WHILE THERE IS STILL SOME LIGHT OUTSIDE. NOW WITH ACCESS TO LIGHT I AM ABLE TO GO TO ONE MORE HOUSE FOR WORK IN THE EVENING" SHIVAMMA, DOMESTIC HELPER.

Entrepreneur Kumar's shop in Kariammana Agrahara (Post IEC intervention)
Source: SELCO Foundation

In case study 2, one of the biggest problems that came up in the needs assessment was a threat from snakes, rodents and scorpions - biting young children and infants in the dark. As one of our interviewees stated, "We have snakes and rats here, sometimes even mad dogs enter our community. How do we check if there is a snake in our tent, if we can't even see?"- Radhava.

In case study 1, Mahesh Foundation doctors are positive that with a regular health clinic, the health levels and practices within the community have started transforming. Dr Faraz noted a decrease in children's bronchitis cases since the kerosene lamps in households have been replaced by LED bulbs charged at the IEC. Also, as mentioned earlier, it has resulted in creating evidence as well as identifying some of the preventive health measures, like access to clean drinking water, that can be taken in the community by analysing disease patterns. A solar powered water purification system is scheduled to be installed by end of March 2016.

Further, while there is anecdotal evidence of the benefits of clean lighting solutions on indoor air quality, studies to capture and quantify the effects need to be carried out.

3.3. ECONOMIC BENEFITS AND SAVINGS

As we go down the poverty ladder, the cost of energy goes up. Spending approximately 30-40% of their monthly income on unsustainable and harmful energy fuel, this expenditure is a representation of their citizenship, as discussed in introduction. The high expenditure reflects their limited access to the Public Distribution System (PDS)[4] and high black market prices based on their location.

4 Kerosene is subdised through the Public Distribution System and targeted at households that are below the poverty line (BPL) and have the documentation to prove the same. Through the PDS BPL households can purchase up to 5 litres of kerosene/month at a subsidised cost. However, studies have shown that approximately 50 per cent of poor households do not have a BPL card (Lang and Wooders, 2012).

Some people get the first few litres of kerosene subsidized and then have to buy the rest on the black market. On average, from baseline studies, 1 litre of kerosene through PDS costs Rs. 30 for the first 5 litres. Any additional kerosene needs have to be met through the black market at Rs. 60 per litre. On average, households without access to the PDS system spend Rs. 300 per month on kerosene. By investing approximately Rs. 200 per month on solar lights, the household will get better quality lighting, reduce indoor environmental pollution and also save money as compared to kerosene. In addition, by looking at preventive healthcare measures (less exposure to kerosene fumes, access to clean drinking water), the IEC results in indirect savings by avoiding regular expenditures on private health clinics (public health infrastructure may not be accessible in some case due to legitimacy issues, as explained in introduction).

4. CHALLENGES AND LESSONS LEARNED

4.1. LAND TENURE

The lack of secure land tenure poses a significant challenge when working with these communities. Care needs to be taken to customise solutions such that they do not attract unwanted attention and antagonise the landowner, leading to evictions. In the case of evictions solutions should be easily packed and moved. There have also been instances where political leaders or landlords in these areas have felt threatened by the work of NGOs in the communities. One way of addressing this has been by including, or seeking endorsement from, these parties for the initiative.

4.2. COMMUNITY DYNAMICS

When entering a community the existing dynamics and power structure plays an important role in gaining buy-in for interventions. In one case an IEC entrepreneur, taking advantage of his monopoly of the market and the need for his services, started charging the community Rs. 20-25 for daily rent as opposed to Rs. 5-7. Addressing such issues requires constant conversations with operators or entrepreneurs so that they understand their social responsibility. However, ongoing follow up and engagement can be resource intensive.

4.3. IMPORTANCE OF CUSTOMIZATION

The above case studies highlight the importance of customization of solutions according to the community needs. While on the one hand the technology systems need to be tested to optimise end user experience and efficiency with the aim of making it more affordable. On the other, customization and innovation needs to be made in delivery mechanisms and approached with a holistic perspective that takes into consideration the social, financial and environmental sustainability of the solution.

4.4. COMPETITION FROM SOLAR LANTERNS

With solar lanterns gaining popularity and being perceived as a universal solution to energy access; inexpensive Chinese made solar lanterns and products with shorter life cycles are currently flooding the market. Due to their inferior quality and the lack of servicing options these products significantly drain household incomes. Additionally, these lights are limited in their utility (only providing lighting) and reduce market confidence in solar technology. The IEC model advocates for going beyond merely a one time lighting solution by providing a sustainable model that evolves according to community needs.

4.5. CHALLENGES IN MONITORING AND EVALUATION

A number of the operators and entrepreneurs we work with do not engage in regular bookkeeping practices, which poses a challenge for effective financial monitoring and evaluation. By visiting the community every 2-3 weeks for rental fee collection and technical assistance, the field coordinators are able to help fill in the gaps in monitoring and remedy any issues that may arise on an incremental basis. This helps provide a data set for future replication.

5. DISCUSSION: SUSTAINABILITY, FUTURE WORK AND POLICY IMPLICATIONS

5.1. FUNDING AND SUSTAINABILITY

While most IECs start as an operator model, the focus is to encourage entrepreneurship and make the IEC model sustainable. Since the IEC is a relatively new concept and there is a significant risk associated with these vulnerable communities, the Foundation takes a larger stake in the initiative in terms of the capital cost. While most funders are keen to set up the IEC, they are more reluctant to support any expansions or innovations. Additionally, when an operator is interested in expanding his services and becoming an entrepreneur, refinancing from traditional channels such as banks becomes an issue. Thus, building relationships and establishing strong financial linkages with a range of institutions - banks, donors, micro finance institutions, etc is critical.

5.2. FUTURE WORK

While scaling of solutions is critical, SELCO Foundation does not define scaling as “supersizing” the organization to spread a standardised solution (which is convention in the business world). Diverse terrains, issues, and socio-economic conditions in India push for contextual innovation at different levels. Multiple challenges are overcome by customised technical and financial service solutions.

If we look at the detailed case studies and break them down into processes that were used to analyse the need, address issues of ownership, land tenure, operations and monitoring, they are very different. Thus, to ensure that interventions impact and sustain, it is important to localize

the solutions. If we see the concept of IEC as a model that looks at electricity access to off-grid vulnerable communities, or as a concept that encourages shared economy, it can further be replicated to address other issues that come with energy poverty by scaling the processes and concepts as opposed to one specific model.

A model to provide energy to off-grid livelihood activities: The insecurity of tenure and informality of a migrant labour settlement can be compared with the vulnerability of street hawkers or similar communities. Replicating the financial model of an entrepreneur run IEC, a central charging station in one of the hawker[5]'s home, who then delivers the light to the other hawkers operating out of the same market or neighbourhood, can be used to address the electricity issues in such a scenario. Adoption of this model can also be explored to meet the electricity needs for other vulnerable communities such as those displaced by natural disasters, refugees, etc.

5 A person who travels around selling goods

A model that encourages shared rather than individually owned resources: The concept can also be seen as a rental model for technologies that are expensive but don't require constant usage. Shared resources ensure energy efficiency and economic viability. Shared water pumps in rural areas combined with night-time drip irrigation can reduce water usage and increase economic viability of irrigation. IECs have the potential to anchor such capital-intensive resources through shared ownership in rural and informal settlements.

5.3. POLICY IMPLICATIONS

The energy access sector has the potential for a range of business models, across technologies and scales of operation. However, there are certain critical components that have to be in place for the sector to succeed and scale. By enabling these critical components, any delivery model should be able to sustain and flourish. Thus, for more organisations to be successful in providing energy access to the poor, it becomes crucial to shift the focus from technology alone, to considering a holistic approach that looks at other factors in the ecosystem such as combining customized technology with affordable financing; a sustainable dissemination and maintenance mechanism; and a conducive entrepreneurship and policy framework (Figure 3).

Ecosystem building decentralized renewable energy solutions

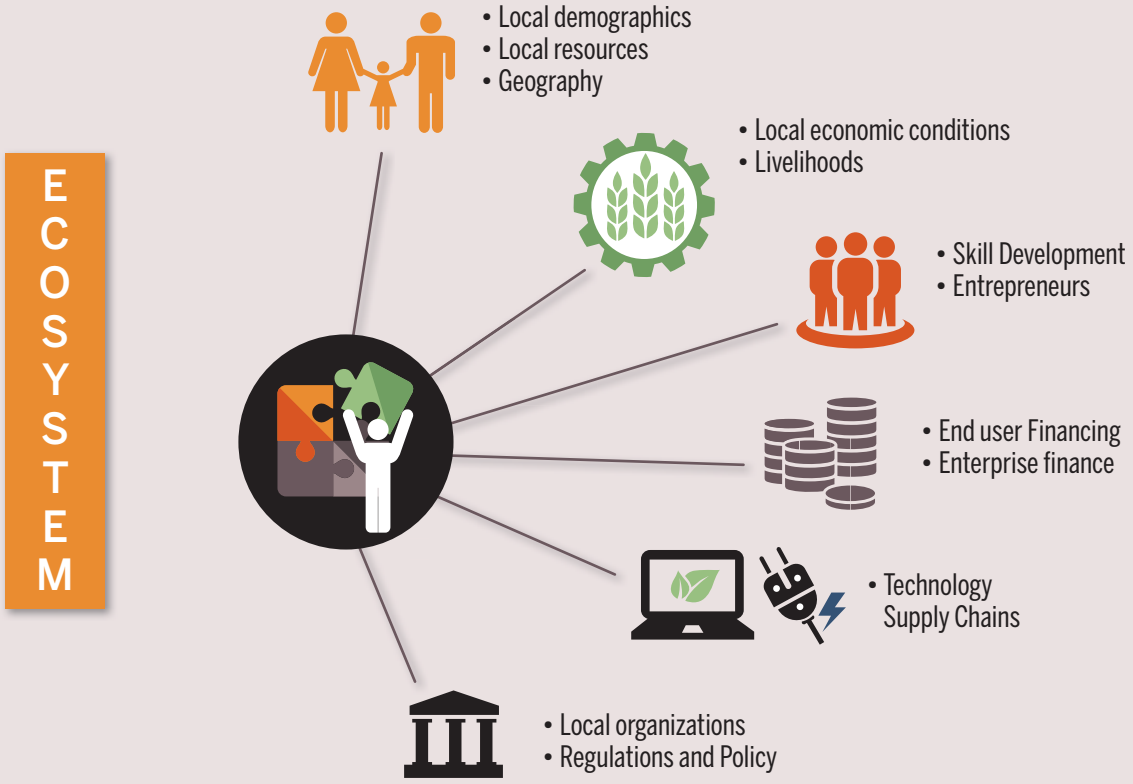


Figure 3

During the course of writing this article there have been a number of evictions in the communities that we work with. Further emphasising the need to address issues related to migrant communities in a more holistic manner such as land rights and the need for the government to intervene on affordable housing. Government can adopt a two pronged approach, one that addresses the issue of distress migration caused due to lack of livelihood opportunities in rural communities. And two, ensure that cities are more inclusive and provide affordable access to basic housing and basic resources and amenities for these migrant communities. Current conversations in India are focused on ambitious and innovative ideas such as Smart Cities and Digital India. Ironically, a large proportion of urban migrants are engaged in building and catering to the needs of these Smart Cities that have no room for them.

While further studies that measure the direct and indirect impact of the IEC over time will be useful in influencing policy change and replication in other contexts, some specific recommendations from a policy perspective are:

- Awareness campaigns about the benefit of clean energy and the health implications of using polluting fuels such as kerosene.
- Rationalising of government subsidies for kerosene that can be re-directed to finance cleaner alternatives.
- Addressing issues of urban migrants and affordable housing.
- Provisions for financing across the supply chain, including for the entrepreneur and the end user.

CONCLUSION

Lack of opportunities, climate change, caste dynamics, dwindling natural resources, local conflicts, war, etc. are some of the reasons for increased vulnerability of underserved populations. To escape from the impending challenges, some migrate and many others try to face it with whatever meager means they have. In many cases the vulnerability has increased, just that the variables have shifted from one part of the eco-system to another.

Integrated Energy Centers (IEC), as a concept, was thought about to mitigate some of the short term challenges of these communities, paving the way for medium and long term solutions to help them get out of the vulnerable situations they find themselves in. As shown by pilots implemented by SELCO Foundation and its partners, the concept of IEC is highly customizable thus providing the flexibility to be replicated across all types of populations – rural, urban, tribal, migratory, disaster affected etc. The initial sets of IECs have also explored a broad range of ownership models from being entrepreneur run to community owned. The IECs can also be an ideal first channel to optimize the connection of energy and essential services like education, health, water and livelihoods: especially to the underserved communities by providing them a way to avail services with minimum infrastructure related resources.

IECs are in no way a long term or permanent solution, but help ensure that vulnerable populations (and more importantly generations) do not lose out on critical parameters of development (like energy access, health, education and livelihood opportunities). In the larger context, IECs can be the very foundation for new types of innovation in technology utilization, business model applications, models for delivery of essential services, new methods of social inclusion etc.: aspects critical to lessen the technology, financial and social divide for the poor.

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